

Phosphorus Source Identification Report for the Merrimack River (MA84A-04) and Tributaries

For compliance with the National Pollutant Discharge Elimination
System General Permit for Stormwater Discharges from Small
Municipal Separate Storm Sewer Systems in Massachusetts

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JUNE 2022

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1

Introduction

This Phosphorus Source Identification Report (PSIR) was developed in accordance with the 2016 National Pollutant Discharge Elimination System General Permit for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems in Massachusetts (MS4 Permit), Appendix H, Part II. b. This PSIR addresses regulated property owned and/or operated by the Massachusetts Department of Conservation and Recreation (DCR) that discharges to the Merrimack River segment MA84A-04 and its tributaries. DCR owns and operates property across Massachusetts, some of which generates MS4 regulated stormwater discharges. The purpose of this report is to identify discharges that are contributing to the Merrimack River watershed's phosphorus impaired water bodies and to devise an effective approach for reducing this contribution. This PSIR identifies and prioritizes catchments with high nutrient load discharges.

The methods used to develop this PSIR are explained in depth in DCR's Approach Document entitled "Methods for Phosphorus Control Plan & Nutrient Source Identification Report Development," submitted separately to EPA. Referred to simply as the DCR Approach Document, the document includes methods for determining which portions of DCR facilities are regulated, delineating drainage catchments within facilities, calculating pollutant loading, prioritizing catchments, and determining appropriate organization of impaired water body segments for inclusion in this report.

Results of this PSIR are presented in the DCR NSIR & PSIR Web Application, which can be found at the following link:

<https://vhb.maps.arcgis.com/apps/dashboards/4cfdc963fe0442aba6e91c69c05064ac#mode=view>

For reference, Appendix A includes metadata for each layer presented in the web application.

2

Waterbodies Subject to PSIR Requirements

Segment MA84A-04 of the Merrimack River, as defined by Massachusetts Department of Environmental Protection (MassDEP), is water quality limited for phosphorus based on the MassDEP's Final 2016 Integrated List of Waters and does not have an approved Total Maximum Daily Load (TMDL).¹ Therefore, under Appendix H of the MS4 Permit, DCR is required to develop a PSIR to address phosphorus load in stormwater discharges from DCR's MS4 to this water body segment and the segment's tributaries. DCR discharges stormwater to several nutrient limited water bodies without TMDLs that are also subject to PSIRs and which are located upstream of segment MA84A-04, i.e., within the watershed of and tributaries to MA84A-04 (Table 1). Therefore, these additional water bodies are also included in this report. The DCR NSIR & PSIR Web Application displays each of these nutrient impaired water bodies, their watersheds, and the MS4-regulated DCR facilities within the watersheds.

¹ MassDEP. Massachusetts Year 2016 Integrated List of Waters: Final Listing of the Condition of Massachusetts' Waters Pursuant to Sections 305(b), 314 and 303(d) of the Clean Water Act. December 2019. <https://www.mass.gov/doc/final-massachusetts-year-2016-integrated-list-of-waters/download>

Table 1 Waterbodies Included in this PSIR

Water Body Name	Water Body ID
Nashua River	MA81-05
Nashua River	MA81-07
Nashua River	MA81-09
Carding Mill Pond	MA82015
Grist Mill Pond	MA82055
Hager Pond	MA82056
Waushakum Pond	MA82112
Whitehall Reservoir	MA82120
Hop Brook	MA82A-05
Hop Brook	MA82A-06
Unnamed Tributary	MA82A-15
Unnamed Tributary	MA82A-16
Unnamed Tributary	MA82A-17
Long Pond	MA83010
Merrimack River	MA84A-02
Merrimack River	MA84A-03
Merrimack River	MA84A-04

3

Regulated MS4 Area

(Meets Appendix H, Part II.1.b.i.1 & Part II.1.b.i.3)

This section discusses the regulated area subject to the MS4 permit. Specific methodology for determining DCR's regulated areas is included in the DCR Approach Document. For the purposes of stormwater load and treatment analysis for this PSIR, catchments were delineated within DCR facilities. Catchments within DCR parcel boundaries were delineated using 3-meter resolution contour data, DCR stormwater drainage infrastructure, the latest available aerial imagery, and best professional judgement to approximate drainage boundaries and estimate stormwater catchment areas. These catchments do not necessarily align with catchments delineated for illicit discharge detection and elimination (IDDE) purposes. Table 2 presents the total regulated MS4 area within the watershed, including the estimated impervious area, directly connected impervious area (DCIA), and pervious area.

Table 2 Regulated MS4 Area

Merrimack River MA84A-04 Watershed	Area (acres)
Impervious Area	35
Directly Connected Impervious Area	15
Pervious Area	111
Total Regulated Area	146

*Note: Areas above do not sum to equal total regulated area as DCIA is a subset of IA

Methods for calculation of total impervious area and directly connected impervious area (DCIA) are included in the DCR Approach Document. Total impervious area and DCIA for each catchment is included in the DCR NSIR & PSIR Web Application within the attribute fields of the Catchment polygon layer.

3.1 Monitoring Results

(Meets Appendix H. Part II.1.b.i.2)

Results from dry and wet weather screening and sampling of DCR's outfalls and interconnections in this watershed are publicly available at the following URL as provided in the DCR MS4 Annual Report: <https://vhb.maps.arcgis.com/apps/webappviewer/index.html?id=87a35a2683aa4478a07ade7ffb7c1b2a>

Phosphorus concentrations measured during IDDE monitoring are from one-time grab samples and are not indicative of annual loads. Therefore, these results were not used when prioritizing catchments for load reduction. Outfalls that were found to have dry or wet weather flow with sewer input indicators will be addressed as part of DCR's MS4 IDDE program, adding to the phosphorus load reduction planned in this PSIR.

4

Load Reduction Planning

(Meets Appendix H. Part II.1.b.5)

As part of DCR's good housekeeping requirements, fertilizer management, and sediment and erosion control practices, pollutant load reductions from DCR MS4 facilities will come from many approaches, including source controls. As DCR properties are developed and redeveloped, DCR's post construction requirements and policies require water quality treatment which will result in pollutant load reductions.

This PSIR and planning effort focuses on prioritization of higher loading catchments for the potential of treatment through retrofits or planned new or redevelopment construction work for those catchments. DCR will continue to evaluate and plan structural controls for properties identified as presenting potential load reduction opportunities in Permit Year 4. This summary of potential structural controls will be submitted as a deliverable to EPA in Permit Year 5.

4.1 Phosphorus Loading

(Meets Appendix H. Part II.1.b.i.4)

To prioritize DCR facility drainage catchments with high phosphorus loading, a GIS desktop analysis was performed to estimate annual average phosphorus loading for each MS4 regulated catchment. This analysis accounted for land use, land cover, and soil type, and the method is described in more detail in the DCR Approach Document. The results of this analysis are displayed in the DCR NSIR & PSIR Web Application with each catchment's annual average phosphorus load included in the attribute fields of the Catchment polygon layer. This total catchment load was divided by the catchment's total area to develop the catchment's phosphorus load per area (or loading rate). Pop-ups display these estimated loading rates when an individual catchment is clicked. Further details of the web application symbology and attributes are included in Table 3 and Appendix A.

4.2 Catchment Prioritization

In order to prioritize among catchments of different sizes and land uses within the watershed, the metric of nutrient load per unit area was used. DCR developed a ranking system based on this metric to ensure consistent identification of priority catchments across this watershed and all other nutrient source identification report watersheds.

Table 3 Catchment Prioritization

Catchment Priority	Loading Rate (pounds/acre/year)	NSIR & PSIR Web Application Color	Count of Catchments
High Priority	≥ 1.00	Red	8
Medium Priority	0.30 to 0.99	Orange	15
Low Priority	≤ 0.29	Green	32

The development of this ranking system is discussed further in the DCR Approach Document. The DCR NSIR & PSIR Web Application indicates catchment priorities with a stop-light color scheme, as indicated in the table above. DCR property not subject to the requirements of this PSIR are also included in the Catchment polygon layer and are displayed with gray hatch-marks. Further details about the Catchment polygon layer are included in Appendix A.

4.3 Potential Retrofit or Redevelopment Opportunities

The catchments included here will be further evaluated in Permit Year 5 for stormwater treatment with a focus on the high priority catchments. DCR's opportunities for structural stormwater treatment within this watershed include incorporating structural best management practices (BMPs) into stand-alone stormwater retrofit projects or site redevelopment projects. DCR's prioritized catchments based on estimated pollutant loading (Section 4.2) identify areas where implementing stormwater treatment could result in the largest impact. Within these catchments, DCR's best retrofit opportunities occur under the following conditions:

- › Impervious area can be removed
- › Impervious area can be disconnected
- › Impervious area is already disconnected but can be established formally as a BMP (increasing the likelihood of disconnected area being maintained over time)
- › Existing BMP can receive more impervious runoff or be altered to increase treatment performance
- › Significant amount of impervious surface can be collected and processed through a new BMP
- › Available space exists for an above-ground BMP (easier to construct and maintain than a below-ground BMP)
- › Location is easy to access for construction, inspection, and maintenance activities

Although the above conditions represent the most ideal scenarios for retrofit opportunities, DCR is open to creative designs, underground measures, and small-scale controls as well.

DCR also understands that redevelopment projects are cost-effective opportunities to implement additional stormwater treatment. As part of the MS4 Permit's post-construction requirements, DCR is required to provide treatment during redevelopment projects that disturb one acre of land or more. However, many redevelopment projects do not meet this land disturbance threshold. DCR has created a Stormwater Handbook that outlines the agency's approach to redevelopment projects. The Handbook guidance encourages incorporating BMPs during maintenance projects or projects that disturb less than one acre; two project types that would otherwise be exempt from the post-construction treatment standards. The Handbook also prioritizes impervious cover disconnection and infiltration when possible due to infiltration's superior load reduction. The implementation of these policies will support DCR's installation of structural controls within this watershed.

As part of MS4 Permit Year 5 work, DCR will continue to evaluate catchments with high pollutant loading to identify specific locations for retrofits or installation of BMPs during redevelopment. DCR will review regulated catchment areas for simple stormwater improvements and improvements during redevelopment work. DCR will also identify at least one catchment in the Merrimack River PSIR watershed for the installation of a demonstration structural BMP project by Permit Year 6.



DCR NSIR & PSIR Web Application Metadata

Table A1 below provides reference metadata for the DCR NSIR & PSIR Web Application accessible at the URL below.

<https://vhb.maps.arcgis.com/apps/dashboards/4cfdc963fe0442aba6e91c69c05064ac#mode=view>

Table A1 **DCR NSIR & PSIR Web Application Metadata**

Layer Name	Description	Source	Feature Class
Catchment	Subdivides DCR property based on the catchments' "discharge priority," which is an attribute that provides information such as whether the property is subject to NSIR requirements. Catchments with a discharge priority of high, medium, or low (colored in red, orange, and green, respectively) are subject to NSIR requirements. These catchments are subdivided based on gross drainage patterns and given a discharge priority designation based on their need for stormwater treatment (high being the most in need, etc.). Catchments with a discharge priority of non-discharge, unregulated, or outside NSIR watershed (symbolized with diagonal, horizontal, and vertical gray hatched lines, respectively) are not subject to NSIR requirements; the reason for which is indicated by the discharge priority. These areas are either outside the NSIR-requiring watershed (outside NSIR watershed), within an unregulated DCR facility (unregulated), or within a regulated DCR facility but does not discharge stormwater (non-discharge).	VHB	Polygon
DCR NSIR Required Watersheds: Parent	Displays the watersheds of the most downstream water body segment of each NSIR report	VHB	Polygon
DCR NSIR Required Watersheds: Child	Displays the watersheds of each NSIR-requiring waterbody segment within the parent watersheds	VHB	Polygon
Nitrogen and/or Phosphorus Impaired Waterbodies: Rivers	"MassDEP 2016 Impaired Waters – Water Body AUs – Rivers (arcs)" data layer filtered for only Total Phosphorus and Total Nitrogen impairments	MassDEP	Line
Nitrogen and/or Phosphorus Impaired Waterbodies: Lakes & Estuaries	"MassDEP 2016 Impaired Waters – Water Body AUs – Lakes, Estuaries (polygons)" data layer filtered for only Total Phosphorus and Total Nitrogen impairments	MassDEP	Polygon